

Comments on the Spent Fuel Project Office's Draft Interim Staff Guidance (ISG) 21 "Use of Computational Modeling Software" were solicited via a Federal Register Notice dated July 12, 2005. The NRC received a wide range of comments from a diverse group of external stakeholders including spent fuel cask vendors, industry groups, utilities, and the Department of Energy. Comments ranged from editorial and clarification comments to comments that questioned the basis for the issuance of the ISG. The comments submitted by external stakeholders, and the staff's responses to those comments, are presented below.

I. Commentor 1

Comment 1 –

Industry commends the SFPO for providing an opportunity for public comment on this draft guidance. We note that this is the first time such an opportunity has been offered for SFPO Interim Staff Guidance and we see this as an important step toward building a participatory process into the development of NRC's regulatory tools. However, with regard to the specific clarifications proposed in ISG-21, we are concerned that the ISG requests information to be submitted for NRC review and approval that is beyond what the regulations require for NRC review of Part 72 license applications and Part 71 and 72 CoC applications. Given this concern, we recommend that this ISG be withdrawn.

Response 1 –

If the use of computational modeling software is part of an application to demonstrate the safety of an SSC, then it is within the scope of Part 71 and 72 licensing and is subject to the same level of review as any other portion of the SAR or supporting documents. If the applicant does not submit sufficient information for staff to make a finding of fact with regard to safety, then the staff must issue a Request for Additional Information (RAI) to receive the necessary information to make such a finding.

Comment 2 –

As a general matter, we encourage SFPO to limit the use of ISGs when other, more appropriate regulatory tools are available. In this case, if the information in the draft ISG needs to be formalized, it would be better suited for a revision to one or more existing Regulatory Guides (RG) that address the format and content of a license/CoC application (e.g., RGs 3.48, 3.61, and 3.62) than an ISG. ISGs often have the effect of creating de-facto requirements that lack the same rigor of process that should characterize the promulgation of such requirements, and hence, have the potential for creating unintended and problematic consequences.

Response 2 –

The intent of Interim Staff Guidance is to communicate the staff's position on a technical issue that if employed, would result in a more efficient and effective review process. There is no intent to create de facto requirements with the issuance of ISG's. The Standard Review Plans related to review of storage and transportation casks and packages as well as storage facilities are issued under

the same principle. They provide guidance to the staff, as well as potential applicants, as to how reviews should be conducted. The staff acknowledges that applications that follow staff guidance, contained in either an ISG or the SRP, can be reviewed more efficiently. Applicants can deviate from any of the guidance issued by the staff, provided they present adequate justification for their approach. Neither Interim Staff Guidance, nor NRC Standard Review Plans should be interpreted as regulation or requirements imposed on the applicant.

Comment 3 –

The specific problematic consequence of draft ISG-21 is that it effectively requires that applicants submit, either as part of the Safety Analysis Report (SAR) or in related documentation, detailed information that is typically only found in the supporting calculation packages for a license/CoC application or in a Topical Report specifically requesting NRC approval of a calculational method used in licensing an Independent Spent Fuel Storage Installation (ISFSI) or a cask design. The amount of information to be submitted with the license/CoC application in accordance with ISG-21 and reviewed as part of the licensing process exceeds that contemplated by the regulations.

Response 3 –

The staff disagrees with the comment for the following reasons:

- 1) advanced Computation Modeling Software and computing hardware are now utilized to perform complex analysis which complements or supersedes experimental testing;
- 2) computer analysis results are now being used to justify cask designs that operate closer to material temperature limits and code allowables for stresses and/or strains. This means that additional care must be taken in a safety review of submitted analyses.

The staff's position is that it is more effective and efficient to obtain the necessary analysis information needed to support our findings in the applicant's initial submittal, rather than having to request this information via Requests for Additional Information (RAIs), thereby, increasing review time. In addition, much of the information related to an applicant's analysis can be supplied in a calculation package, rather than in the SAR.

Comment 4 –

The regulations (10 CFR 72.24, 72.230, and 72.236) require applicants to describe the design criteria and design bases for the ISFSI/cask system and to design the ISFSI/cask system to meet certain objectives, including thermal performance and structural integrity under appropriate design basis conditions. The regulations do not require the submittal of information of the level of detail enumerated in the draft ISG. This information typically is documented by the applicant in the calculations supporting the application and in analysis code verification/validation records maintained by the applicant in accordance with their NRC-approved QA program. Submittal of this information would be a huge,

additional burden to the applicant, as well as for the NRC review staff, causing delays in the review process without commensurate benefit to safety.

Response 4 –

See Responses 1, 2, and 3 above regarding the purpose of an ISG. In general, the staff conducts audit reviews of the thermal and structural performance of spent fuel cask and package designs. This ISG does not change the basic philosophy of review of the staff.

When cask designs are manufactured and placed into service, for either storage or transportation, these casks behave as systems. For the staff to properly conduct an audit review of any one part or feature of a cask system, information about the entire system is necessary. The staff has the obligation to verify that the input and output are correct for a given cask or package analysis, to make a regulatory finding.

Comment 5 –

We suggest that NRC work with industry to determine what information should be appropriately provided in the license/CoC application and what should be contained in the supporting calculations. Regulatory Guides that provide format and content guidance for applications could then be updated accordingly.

Response 5 –

The staff remains committed to working with industry to further refine the review process and accepts recommendations on the review of applications; however, the staff is ultimately responsible for the safety evaluations that are produced as a result of their reviews. Therefore, the staff must make a determination as to what information is needed to perform a review and make a finding.

The purpose of ISGs is to inform applicants, as well as the public, that the staff has developed a position on a technical issue that if employed, would result in a more efficient and effective review process. ISGs should not be interpreted as regulation or requirements imposed on the applicant. They provide one possible approach to a given technical issue that the staff deems appropriate. An applicant is entitled to provide the information it deems necessary to satisfy the regulations in an application, which the staff will then evaluate.

II. Commentor 2

Comment 1 –

Lines 88 through 90 state “... for any CMS used as the basis for demonstrating the cask design satisfies regulatory requirements, adequate validation of that CMS must be demonstrated by the applicant.” Does this requirement apply to previously used and accepted CMS applications?

Response 1 –

The staff does not “accept” or “approve” specific CMS applications. If information regarding the validation of a specific CMS application has been previously submitted, the staff would request that any such previous validation

be incorporated by reference. CMS is a tool used by applicants to analyze performance of a specific design and, as a result, does not constitute a methodology; therefore, the use of a given CMS application in previous submittals does not provide a priori acceptance by the staff of analyses that utilize the same CMS application for subsequent submittals. The staff will evaluate the appropriateness of the modeling approach and analysis results for each individual application, regardless of the CMS application chosen.

Comment 2 –

Lines 92 and 93, and other locations throughout the ISG, use the phrase “provided in the SAR or related documentation.” Please confirm that “related documentation” could include proprietary calculations packages and/or code benchmark reports.

Response 2 –

The staff agrees with this comment. Related documentation could include proprietary calculations packages and/or code benchmark reports. The language in the ISG will be modified.

Comment 3 –

Line 102 states that the reviewer should verify that the application specifies “the release version and applicable platforms” of the CMS applications. This could complicate the use of updated releases of CMS applications for site-specific calculations required for 10 CFR 72.212 evaluations. Given that a cask Certificate of Compliance remains in effect for 20 years, commercial CMS application vendors will inevitably stop supporting the “approved” release versions. Does the SFPO intend that a license amendment would be necessary to use an updated CMS application?

Response 3 –

The validity of analysis results is based on the release version of the software that created such results. This means that applicants can use updated versions of the software without prior approval, as long as the staff does not prevent the use of updated versions of software in the CoC or Technical Specifications. The criteria for whether or not a license amendment would be needed is contained in 10 CFR 72.48 and supporting guidance.

Comment 4 –

Lines 116 and 117 state “Input files should be thoroughly annotated...” This is not possible for all CMS applications. In addition, such input files would likely be considered proprietary by cask suppliers.

Response 4 –

This is a preferred method of submission, not a required method of submission. The applicant should submit what they believe is required for the staff to make a finding. There are procedures in place for NRC staff to properly review and handle proprietary documents.

Comment 5 –

Line 207 states that the reviewer should assess “the consistency of units for material properties throughout the SAR.” Does this imply that NRC reviewers would expect all chapters of a SAR to use the same unit systems? We think this could actually increase the likelihood of unit errors, as different sources of material properties data will use different units, necessitating extra unit conversions just for SAR presentation.

Response 5 –

The intent of this guidance was for units to be consistent within a given discipline chapter. The language in the ISG will be modified.

Comment 6 –

Lines 211 through 213 use nomenclature that appears specific to the ANSYS finite-element program (i.e., material numbers). This cannot be applied to all CMS applications. In addition, should the phrase “listed in the SAR in tabular format” actually read “listed in SAR or related documents in tabular format” to be consistent with most other statements in the ISG?

Response 6 –

The staff agrees with this comment; however, to offer further clarification, the staff intends for reviewers to be able to easily determine what materials are present in the analysis model. One way of accomplishing this is to provide either a material or component/assembly number that corresponds to the analysis model, in the material properties tables, wherever they appear. The language in the ISG will be modified.

Comment 7 –

Lines 224 and 225 state that the reviewer should “...verify that a sufficient explanation of the logic behind the creation of each specific computer model is provided, in order for effective confirmatory calculations to be performed.” Would a confirmatory model constructed by following such an explanation then be influenced by the applicant’s modeling choices and, therefore, no longer be independent?

Response 7 –

No, the staff disagrees with this comment. The relevant text states “... a sufficient explanation of the logic” which the staff interprets as a general statement or statements of notable modeling techniques. In addition, there is no statement in this section regarding independent confirmatory analyses. The text references effective confirmatory calculations which are different from independent confirmatory analysis.

Comment 8 –

Line 229 states that the reviewer should “... verify that the applicant has provided annotated input files” As we stated in our comment 3 above, this is not possible for all CMS applications.

Response 8 –

See section II, Comment 4, Response 4.

Comment 9 –

In Line 233, should the phrase “in the appropriate SAR chapters” actually read “in the appropriate SAR chapters or related documents” to be consistent with most other statements in the ISG?

Response 9 –

The staff agrees with this comment. The language in the ISG will be modified.

Comment 10 –

Lines 261 and 262 state “The discussion of sensitivity studies should be included in the general model discussion noted above with relevant references to examples included in the SAR or in any appendices.” Does this statement indicate that the discussion of sensitivity studies should be included in the SAR (with references to examples that may be elsewhere), or that the references to examples should be included in the SAR so that the discussion of sensitivity studies (which may be elsewhere) can reference it? Alternately, should the phrase “in the SAR” actually read “in the SAR or related documents” to be consistent with most other statements in the ISG?

Response 10 –

A textual description of relevant sensitivity studies, either in the SAR or related documents, should be provided as part of the submission. If a particular sensitivity study cannot be sufficiently describe textually, then the related analysis files should be included with the submittal. The staff must be able to verify that the approach taken is representative and valid.

Comment 11 –

Line 284, 302, 321, and 329 all use the phrase “Finite Element Analysis.” Should this phrase be replace with the more generic term “computational modeling software?”

Response 11 –

The staff agrees with this comment. The language in the ISG will be modified.

III. Commentor 3

Comment 1 –

Lines 139 to 143 are worded very poorly. The Staff cautions about oversimplifications to cask models, but then goes on to say that you can produce accurate results with simplified models. I think the wording here needs to be more precise as to more specifically describe what is discussed in lines 121-123; that is, the licensee should provided a detailed explanation for why any simplifications are made and why a more sophisticated representation is not required (due to modeling time, geometric negligibility, etc.).

Response 1 –

The staff agrees with this comment. The language in the ISG will be modified.

Comment 2 –

In my opinion, lines 221-224 are not needed. This could put a significant, undue burden on the licensee. Since the Staff already expects and requires the model description in lines 121-123, and further in 135-137, it is not necessary to discuss the minutia of how geometric elements are combined, trimmed, extruded, etc., to produce a finite element or finite difference model. It appears that the Staff may want this information to provide to their consultants to fast track a confirmatory or counter model; does this conflict with intellectual propriety of the organization(s) that constructed the model to provide this level of detail? The textual descriptions of the model preparation and the annotated input file should more than suffice.

Response 2 –

The staff agrees that the description of routine modeling procedures utilized for construction of model geometry are not needed to make a safety determination; however, the staff does need enough relevant information about the applicant's analysis to perform confirmatory calculations, should they be necessary (See Section II, Response 7). If the staff deems it necessary to have a independent confirmatory calculation completed, additional information may be requested from the applicant. Any proprietary information submitted to the staff will be protected as such.

Comment 3(a) –

Lines 244-250 are a good practice, but the wording here is inconclusive. Is it the Staff's intent that detailed mesh, loading, and time sensitivity studies be performed on EACH cask model, at all critical regions?

Response 3(a) –

The staff agrees with the intent of this comment in part. Details of sensitivity studies that are relevant to safety should be provided if a text representation cannot or does not sufficiently describe the sensitivity studies. The staff must be able to verify that the approach taken is representative and valid.

Comment 3(b) –

There are significant amounts of mesh density and refinement studies and experiments on a wide range of components and structures, under various loading conditions, available in engineering literature. Depending on the applicability to the cask models, could this also suffice? While mesh sensitivity studies are very beneficial, they can also greatly exacerbate and exponentially increase the time and cost of model development, often with little tangible results.

Response 3(b) –

The staff agrees with this comment and the ISG will be revised to include other sources of sensitivity studies so long as they are submitted for review to determine relevance. In general, sources should be from a peer reviewed or otherwise qualified technical journal and be appropriately documented.

Comment 3(c) –

I agree mesh adequacy is one of the top priorities (along with proper load and boundary condition modeling), but the tone of these lines suggest substantial, additional analyses that may not be needed based on available literature and expertise. The level of mesh refinement sensitivity studies should also be proportional to the type of analysis being performed; for example, a finite element-based fracture mechanics model, with a crack modeled, or a nonlinear stress evaluation of a critical section, may require a multiple mesh densities evaluations to determine accuracy and convergence. But other models (such as many heat transfer models and linear static stress analyses) are not affected as drastically by the mesh density.

Response 3(c) –

The staff agrees in part with this comment. Most sensitivity analyses are unique to a given problem type or class. The determination of whether or not a sensitivity study is needed is an applicant's decision, subject to staff review.

Comment 3(d) –

Additional clarity in what types of mesh sensitivity studies can be used to support the licensee's analysis would be beneficial in this section.

Response 3(d) –

See Section III, Comment 3b, Response 3b

IV. Commentor 4

Comment 1 –

The Interim Staff Guidance (ISG) should be revised to state that validation and benchmarking documentation may be provided once and referenced in subsequent safety analyses. Providing the documentation for each use is cumbersome and provides little benefit.

Response 1 –

The staff agrees and the ISG will be revised. Information regarding validation and benchmarking for a particular CMS application need only be submitted once and by reference thereafter, provided that the validation or benchmarking methods remain applicable to the method of analysis for a submitted cask design. If an applicant changes the analysis approach or method, it is possible that previous validation or benchmarking methods may no longer be applicable.

Comment 2 –

Due to the fact that there can be enormous amounts of data involved in the "relevant input and results files," that these data may not be compatible with Nuclear Regulatory Commission (NRC) analysis codes and platforms, and the difficulty in annotating the data files sufficiently to be understood by the NRC, all these files should not be required to be submitted with the original application. Instead, the NRC should require the applicant to discuss how the input files are checked to ensure they are correct and how the output files are checked to ensure they have reasonable results.

Response 2 –

The staff disagrees with the comment. In general, the applicant should decide what input and results files are most relevant to the review of the cask or package performance. Submission of files on electronic media, in the staff's view, is not overly burdensome. Discussions of how input files are checked to ensure they are correct and how output files are checked for reasonable results would also be helpful to the staff, but would not replace the actual submission of input and output files. If the staff is able to execute input files that will generate output results nearly identical to those reported in the SAR, the applicant need not provide the output files. Regarding the request for relevant input and results files, see Section I, Comment 3, Response 3. Regarding the classification of the ISG as a regulatory or other type of application requirement, see Section I, Comments 1, 2, and 3, Responses 1, 2, and 3.

Comment 3 –

Since simplification of a Computational Modeling Software (CMS) model is a justifiable and acceptable means to represent a geometry and reduce the resources needed to complete an evaluation, the NRC should delete the word "accurate" from line 122 and replace it with "representative" to allow for model simplification.

Additionally, the NRC should clarify the term "over-simplified" in line 139. Presumably, the NRC intends to prevent models over-simplified to the point of producing non-representative results, but the NRC should clarify this term to provide the reviewer with a better understanding of its meaning and intent.

Response 3 –

The staff agrees with this comment. The language in the ISG will be modified.

Comment 4 –

Tolerances and contact resistance can have different impacts depending upon the analysis type (i.e., thermal or structural). Additionally, since there are many tolerances in any cask design, guidance to fully account for the range of all tolerances could lead the applicant to perform an excessive number of analyses. The guidance should be clarified regarding which type of analysis it is applicable to and how the results can be affected.

If the term "tolerances" is applicable to the potential change in dimensions due to manufacturing tolerances for structural evaluations, the NRC should revise the ISG to state that tolerances only need to be accounted for in structural evaluations when a load path change due to variations within tolerance limits impacts the structural results.

Response 4 –

The staff agrees with this comment. The language in the ISG will be modified.

Comment 5 –

Presumably, the NRC intends to say "quantifies the assumed conservatism" [in lines 150-152]. Quantification of a conservatism would require the applicant to

quantitatively analyze many cases where a qualitative discussion would be sufficient to show that modeling assumptions are clearly conservative. This would be counter-productive and undermine the process of making conservative assumptions in the first place.

The ISG should be revised to require the applicant to justify and describe, rather than quantify, any credit taken for conservatism in the analysis.

Response 5 –

The staff agrees with this comment. The language in the ISG will be modified.

Comment 6 –

The NRC should clarify whether the applicant is to provide a discussion of each and every error, warning, and advisory message or if a general discussion is acceptable. If the former is the intent of the requirement, the requirement is cumbersome, provides no real benefit to the reviewer and should be deleted.

Response 6 –

The staff agrees with this comment. The language in the ISG will be modified.

Comment 7 –

It is not clear what the NRC means by “all elements” [line 218]. If it is intended to mean that each individual element (i.e., finite elements) be described, it is too cumbersome (since there may be thousands to millions of such elements in the model), and the requirement should be deleted. Alternatively, if the NRC intends that the applicant describe each type of element, this section should be clarified accordingly.

Response 7 –

The staff agrees with this comment. The language in the ISG will be modified.

Comment 8 –

...detailed annotated input files should not be required to be submitted with the application [lines 226-230]. A narrative description of the model assembly should be sufficient. It should also be clarified that irrelevant information (e.g. selection of datum axes and planes, axes of revolution, centerline information, and coordinates) is not required.

Response 8 –

Regarding the request for relevant input and results files, see Section I, Comment 3, Response 3. Regarding the classification of the ISG as a regulatory or other type of application requirement, see Section I, Comments 1, 2, and 3, Responses 1, 2, and 3. The staff agrees that routine modeling tools utilized for construction of model geometry are not needed to make a safety determination. The language in the ISG will be modified.

Comment 9 –

Providing detailed files of all sensitivity studies should not be required to be submitted with the application. The ISG should be revised to only require describing the results of the sensitivity studies.

Response 9 –

The staff agrees in part and the ISG will be revised. The ISG does not provide requirements for applicants. Regarding the classification of the ISG as a regulatory or other type of application requirement, see Section I, Comments 1, 2, and 3, Responses 1, 2, and 3.